

CHAPTER 5

DECONTAMINATION

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Decontamination means neutralizing or removing the contaminant. Emergency teams usually will have to be augmented with specialized equipment before large-area decontamination can be accomplished. Team leaders normally will be required to provide advice on decontamination procedures and will supervise such operations.

PERSONNEL DECONTAMINATION

One of the first priorities at any chemical accident site is to insure that personnel found in or leaving the suspected contaminated area are properly decontaminated. The PDS is used for this purpose. It is established as a control point on the hot line to prevent the spread of contamination. It should be located outside the contaminated area. However, the first stages of decontamination occur on the "hot side" of the hot line. It is of prime importance to determine if any personnel in the area at the time of the accident may have left the scene prior to the arrival of personnel setting up a hot line; thus risking agent exposure, not being treated, and spreading contamination.

LAYOUT OF THE PDS

A typical PDS is shown in figure 6. The actual arrangement will depend on the type and amount of hazardous material involved and the equipment available. Four general principles should be followed when establishing the PDS:

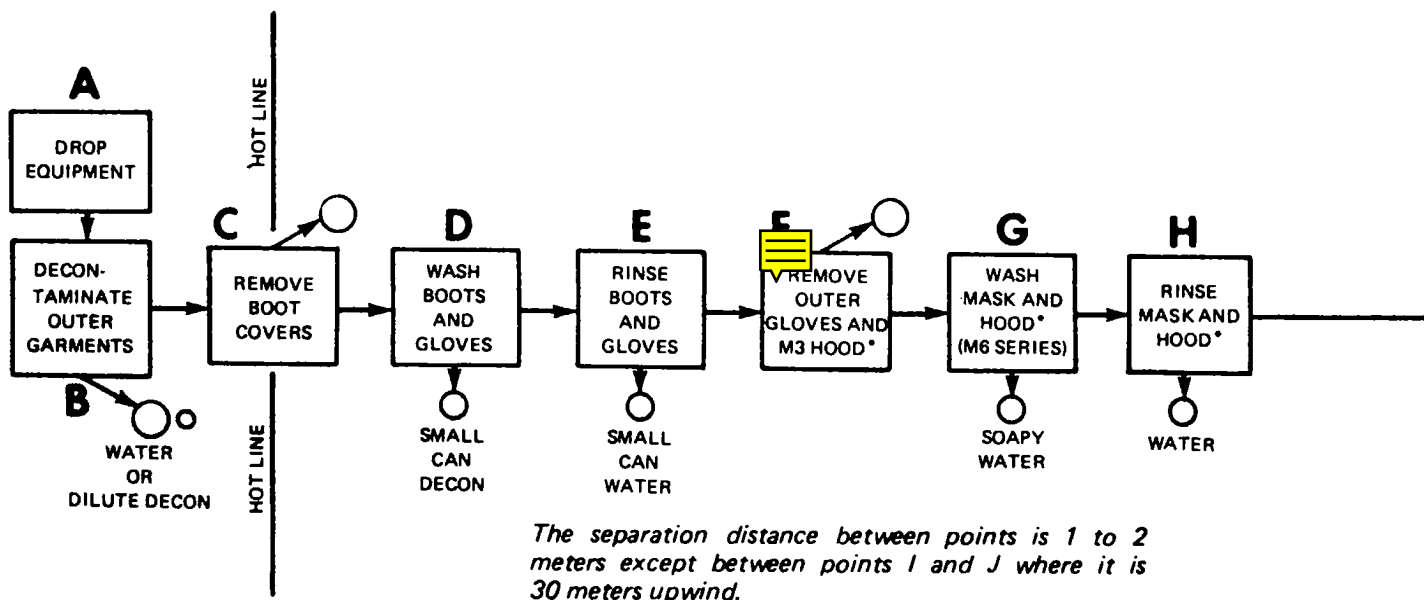
- Move into the wind as undressing progresses.
- Decontaminate and remove the most heavily contaminated items first.
- Follow the undressing sequence and procedures shown in figure 6 as closely as possible. All articles of clothing worn at the site will be removed and decontaminated.

- Remove the protective mask and hood, hold breath, and step directly into shower before resumption of breathing.

EQUIPMENT

The recommended items for the set up and operation of the PDS areas follows:

- Can, utility, 32-gallon, 8 each.
- Bag, plastic, polyethylene, 12 each.
- Can, galvanized or plastic, 10-gallon, 4 each.
- Brush, chassis, and running gear, 4 each.
- Decontaminants. Specific type is determined by agent involved; general-types are DS2 and STB.
- Pail, metal, 3 1/2 gallon, 2 each.
- Soap, powder, 10 pounds.
- Water, 50 to 100 gallons.
- Immersion heater, 1 each (if available).
- Aid station items. Atropine injector, 100 each; M13 decontaminating and reimpregnation kit, 50 each.



*M3 Hood which is worn with the M9 Mask will be removed at point F.
M6 Hood which is worn with the M17 Mask will be removed at point L.

Figure 6. Typical Arrangement of PDS at a CB Accident Site

POINT A — EQUIPMENT DROP

This point will be designated on the hot line for deposit of contaminated equipment returned from the accident/incident site. If a cooling suit is worn, it is removed and deposited at this point. A sheet of plastic, a poncho, or an apron spread on the ground will reduce surface contamination problems. Equipment left at this point will be decontaminated by the undressing assistants after all personnel have been processed through the PDS.

POINT B — OUTER GARMENT DECONTAMINATION

The impermeable suit, to include the hood, apron, and boot covers, will be flushed with water or a dilute solution of an appropriate decontaminant to remove the majority of contamination. The contaminated runoff water should be collected in a sump. A large can is needed to hold the decontaminant, and a brush is required for boot cover decontamination.

POINT C — BOOT COVER REMOVAL

Boot covers are removed and placed in a can or plastic bag. As the first boot cover is removed, the uncovered boot is placed across the line and then the second boot cover

removed. The procedure will reduce the spread of contamination throughout the undressing line.

POINT D — BOOT AND GLOVE WASH

Boots and outer gloves are washed with appropriate decontaminant. Caustic soda solution is not recommended due to the possibility of skin contact. Washing soda (sodium carbonate) solutions, calcium hypochlorite solutions, STB slurry, and hot soapy water are suitable, depending on the agent involved. A small can (10-gallon) should be used to allow submersion of each boot.

POINT E — BOOT AND GLOVE RINSE

A small can of clear water will serve as a second stage wash and will remove decontaminants.

POINT F — OUTER GLOVES REMOVAL

A small can or plastic bag is used for deposit of the toxicological agent protective (TAP) gloves and the hood of the M3 TAP suit.

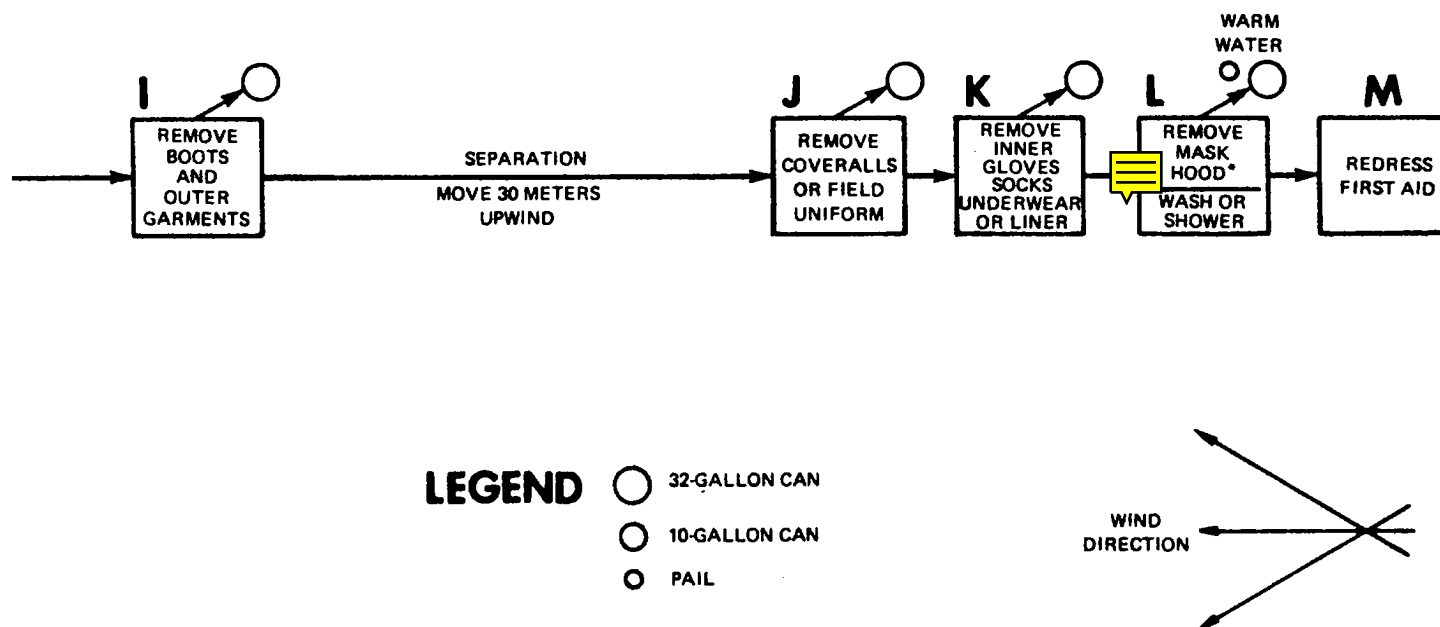


Figure 6. Continued

POINT G — HOOD WASH

The exterior of the M9 mask is washed with hot soapy water, taking care not to allow water to enter the canister. If the M17 series mask is being worn, the entire surface of the M6A2 hood will be swabbed along with the eye-lens and inlet valve covers of the mask. A small can of soapy water and a sponge or rag will be used.

POINT H — HOOD RINSE

A small can of clear water and sponge or rag will be used to rewipe the hood. If the M17 series mask is being worn, follow the same procedure used at Point G.

POINT I — BOOTS AND OUTER IMPERMEABLE GARMENTS

Generally, the rubber boots and M3 TAP coveralls will be removed as a unit. If the TAP apron is worn it will be removed. All rubber items will be placed in a large can or a plastic bag.

Note: Separate point I from point J by 30 meters upwind.

POINT J — CLOTH COVERALLS OR FIELD CLOTHING

If coveralls or environmental field clothing items are worn, these items will be removed and placed in large cans or plastic bags.

POINT K — INNER GLOVES, SOCKS, UNDERWEAR OR LINER

Remove and place in a large can or plastic bag.

POINT L — MASK, HOOD, AND UNDERSHIRT REMOVAL; AND SHOWERING

Undershirt should be removed last. Hold the breath, remove mask and hood, remove undershirt, and move quickly to shower or washpoint. Rinse head and upper body, and resume breathing. Using a small bucket, pour water over body and lather with soap. Rinse with another bucket of water from large can.

Decontaminants for Chemical Accidents/Incidents

Listed in Order of Preference*

AGENT	DECONTAMINANT
Blister H-HN-HD-HT-HL-L	1. HTH-HTB Solution (Calcium Hypochlorite) 2. DS-2 (Decontamination Solution) 3. STB Slurry (Supertropical Bleach) 4. Commercial or Household Bleach Solution (Sodium Hypochlorite)
CX	1. DS-2 (Decontamination Solution No. 2)
Nerve GA GB	1. Caustic Soda Solution (Sodium Hydroxide) 2. DS-2 (Decontamination Solution No. 2) 3. Washing Soda Solution (Sodium Carbonate) 4. STB (Supertropical Bleach) Slurry 5. Hot Soapy Water
VX	1. HTH-HTB Solution (Calcium Hypochlorite) 2. DS-2 (Decontamination Solution No. 2) 3. STB (Supertropical Bleach) Slurry 4. Commercial or Household Bleach Solution (Sodium Hypochlorite)
Blood AC-CK Choking CG	1. DS-2 (Decontamination Solution) 2. Caustic Soda Solution (Sodium Hydroxide)
Riot Control DM DA	1. DS-2 (Decontamination Solution) 2. Caustic Soda Solution (Sodium Hydroxide)
CS	1. DS-2 (Decontamination Solution No. 2) 2. Alcoholic Caustic (Alcohol Mixed w/Sodium Hydroxide Solution) 3. Hot Soapy Water 4. 5 percent Sodium Bisulfite Solution
CN	1. Caustic Soda (Sodium Hydroxide) Solution 2. Washing Soda (Sodium Carbonate) Solution 3. Hot Soapy Water
Incapacitating BZ	1. Alcoholic Caustic (Alcohol Mixed w/Sodium Hydroxide Solution) 2. Sulphuric Acid 1 percent Solution 3. Hot Soapy Water
<i>*The decontaminant selected depends on the type of materiel being decontaminated and its intended use.</i>	

Table 4

AREA AND EQUIPMENT
DECONTAMINATION

Since the types of equipment, surfaces, and hazardous material to be decontaminated will vary with each separate accident, TM 3-220 should be referred to before starting decontamination operations.

Decontaminants are listed in Table 4 for hazardous material that may be encountered and in the order of preference for each hazard. Decontaminants not on hand may be acquired through local supply channels. Table 5 lists the mixing ratio and use of decontaminants for small amounts or when a power-driven decontaminating apparatus (PDDA) is not available. Mixing ratios for PDDAs can be found in applicable technical manuals.

Decontamination can be achieved by neutralizing or removing the contaminant. Allowing the contaminant to weather will not normally be acceptable for hazardous chemical materials at an accident site.

Neutralizing.

- Neutralizing is an excellent method of eliminating the hazard presented by the contaminant. Certain factors must be considered before neutralization procedures are begun.
 - Type of hazard (liquid or solid).
 - Type of surface (soil, vegetation, roadways).
 - Type of decontaminant (best available).
 - Method of applying decontaminant (PDDA, pump, bucket).

DECONTAMINANTS	DECONTAMINATES	MIXING PROCEDURES	CONTACT TIME	REMARKS
Supertropical Bleach (STB)	Blister agents Nerve agents	Dry Mix—2 parts STB to 3 parts earth. Slurry Mix—50 pounds STB to 5 gallons of water. Always add STB to the water stirring constantly.	1. Leave slurry on for 30 minutes. 2. Rinse off with water. 3. Recheck for contamination.	1. Rechecks— GB—Vapor check HD—Vapor check VX—M8 paper 2. Pure undiluted STB will burn on contact with liquid blister agents. 3. DS-2 put on STB will spontaneously ignite. 4. Gives off toxic vapor from G-agents.
Decontaminating Solution No. 2 (DS-2)	All known toxic cml agents.	No mixing required. Issued in ready-to-use solutions.	1. Leave DS-2 on for 30 minutes. 2. Rinse off with water. 3. Recheck for contamination.	1. Can be used at temperatures from -25° to 125° F. 2. Turns M8 paper black. 3. DS-2 put on STB or HTH will spontaneously ignite. 4. Recheck using vapor tests.
Sodium Hydroxide (Caustic Soda)	G-agents Blood agents CN	10% solution—10 lbs. of caustic soda to 12 gallons of water.	Chemical agents—5 minutes.	1. Caustic soda should be slowly added to the water while stirring. 2. Caustic soda should be mixed in an iron or steel container—never aluminum, tin, zinc, copper, or magnesium. 3. Caustic soda turns M8 paper red. 4. Recheck using vapor tests. 5. Possible sources—commercial laundries, chemical firms, drug stores, and manufacturers of metal products.
Sodium Hydroxide in Alcohol-water Solution	BZ CS Unknown powders	Same as sodium hydroxide. Once solution cools, add 12 gallons of either methyl, ethyl, or isopropyl alcohol.	Dissolve agent in solution and allow to stand for 24 hours.	After 24 hours burn the solution using external fuel.
Calcium Hypochlorite (HTH-HTB)	Blister agents V-agents	10% solution—10 lbs. of HTH to 12 gallons of water.	Chemical agents—5 minutes.	1. Rechecks — V agents — M8 paper. Blister—vapor check. 2. DS-2 put on dry HTH will spontaneously ignite. 3. Pure, undiluted HTH-HTB will burn on contact with liquid blister agent and VX. 4. Possible sources—commercial laundries and chemical firms.
Sodium Carbonate (Washing Soda)	CN G-agents	10% solution—10 lbs. of washing soda to 12 gallons of water.	Chemical agents—5 minutes	1. Recheck G agents vapor test. 2. Possible sources—commercial laundries and chemical firms.
Sodium Hypochlorite Solution (Household Bleach)	Blister agents V-agents	No mixing required	Chemical agents—5 minutes.	1. Rechecks—VX-M8 paper. Blister—Vapor check. 2. Use full strength solution. 3. Possible sources—commercial laundries and food stores. (Purex, Clorox).

Table 5

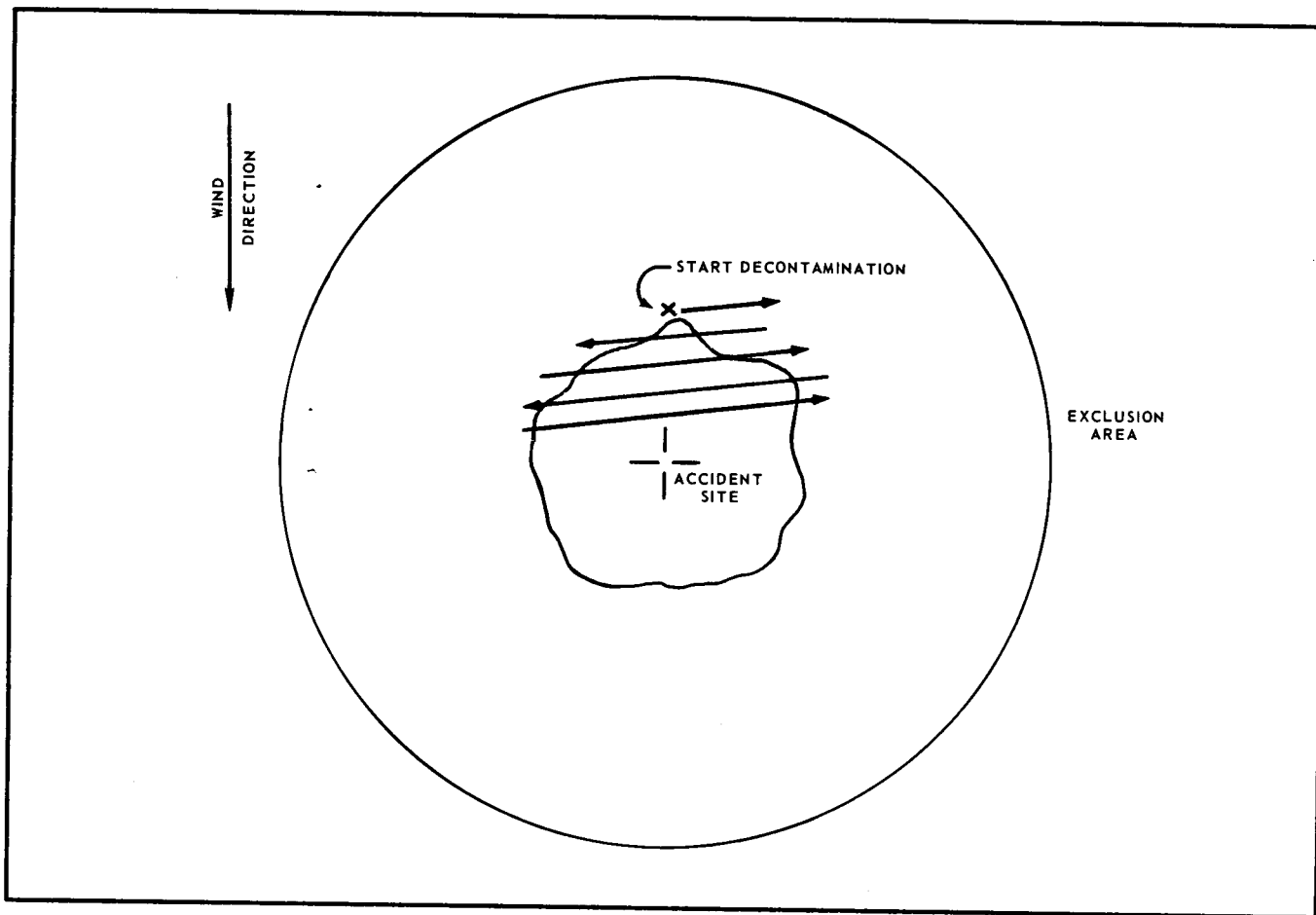


Figure 7. Area Decontamination by the Back-and-Forth Procedure



■ Neutralization procedures for chemical contaminants should begin at the farthest point of contamination from the accident site and proceed inward, moving in a back-and-forth direction (fig. 7) or in a circular direction (fig 8). To insure complete decontamination of the area, operations should begin several meters from known contaminated locations.



Removal. Decontamination by removal consists of physically removing the contaminant from the surface. With heavy liquid contamination on porous soil, this method may involve removal of several inches or possibly feet of soil. However, this method may be preferred in cases when powdered or frozen hazardous material cannot be feasibly decontaminated where it lies or when the material may have been absorbed by the surface. Removal requires considerable equipment and manpower and is quite expensive as a decontamination method. Further, the contamination removed will still require decontamination by some other means.

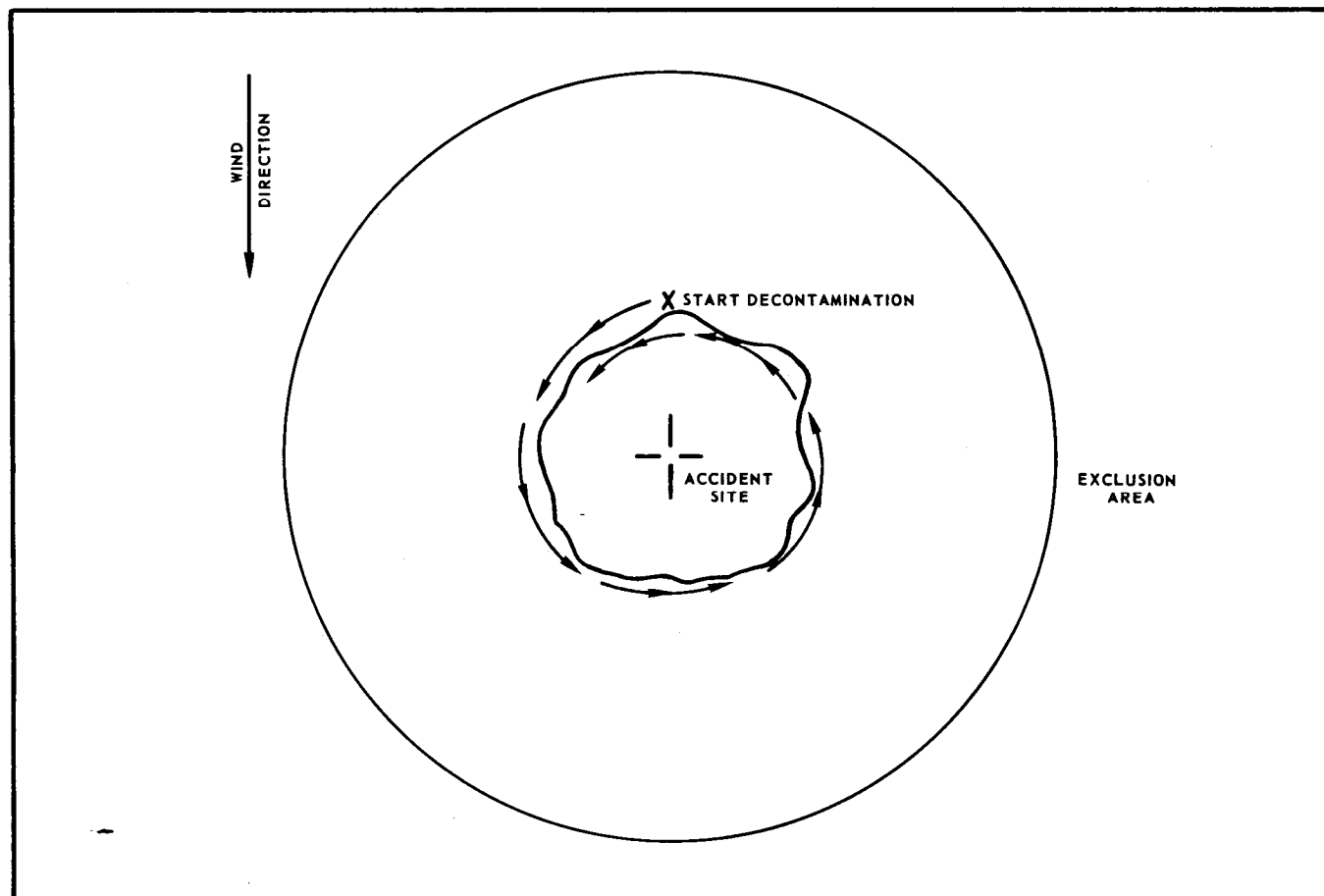


Figure 8. Area Decontamination by the Circular Procedure